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Trade and domestic savings as growth drivers in Ethiopia: Toda–Yamamoto causality approach

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This study examined the causality between trade, domestic savings, and economic growth in Ethiopia. While various research is extensively examined individual impacts of trade and savings on economic growth, the relationships among these three variables remained insufficiently explored, particularly in the Ethiopian context. The study hypothesised that trade drives economic growth, with domestic savings reinvesting its gains creating a reinforcing cycle where higher trade and savings drive expansion. We employed a robust multivariate vector autoregressive (VAR) model and the Toda–Yamamoto causality approach to analyze quarterly data spanning from 1992 to 2023. Our results revealed a significant bidirectional relationship between trade and economic growth, demonstrating that enhanced trade activities not only drove GDP growth but also that economic expansion fostered greater trade volumes. Conversely, domestic savings were found to have no direct causal effect on either trade or GDP, illustrating critical structural issues such as low savings rates and limited access to financial markets. This paper significantly contributed to the existing literature by contextualizing the trade-savings-growth nexus within Ethiopia's unique socio-economic framework. The findings underscored the urgent need for targeted policy interventions that could bolster domestic savings and improve trade competitiveness, ultimately facilitating sustainable economic development in Ethiopia and offering insights applicable to other developing economies facing similar challenges.

Keywords: international trade, domestic savings, economic growth, causality, Ethiopia

Economic literature has extensively studied the relationship between international trade and economic growth. Early research primarily relied on time-series models to assess demand-driven effects, whereas cross-sectional and panel data models explored supply-induced investment and productivity improvements. In the 1960s and 1970s, trade was widely considered the engine of growth in developing countries, whereas domestic factors played a more dominant role in the 20th century. *Singh (2010)* cautioned that correlation does not imply causality

and criticized conventional regression models for treating all regressions as external, overlooking the potential feedback effects of growth and trade. However, in the late 1980s, advanced Cointegration Estimators and Error Correction Models (ECMs) were used in analyses to solve the false regression problem while preserving long-term information.

The theoretical underpinnings of trade-growth dynamics have evolved significantly. *Findlay (1980)* analysed the North-South trade model using a Solow-type North and a Lewis-type South, demonstrating that free trade can equalize growth rates as terms of trade stabilize, given full employment and capital utilization. Subsequent studies have highlighted a positive relationship between trade and economic growth, though the direction of causality remains debated. Empirical findings suggest a bidirectional relationship *(Frankel–Romer, 1999; Hausmann et al., 2007; Keho, 2017; Coulibaly, 2023).* Recent research on Malawi's economy using an ARDL-EC model *(Musila–Mpekansambo, 2024)* confirmed that multilateral trade openness significantly enhances growth in the long run. Furthermore, *Coulibaly (2023)* and *Keho (2017)* emphasized that the positive impact of trade on growth is contingent on governance quality and institutional factors.

In developing countries, trade structures are often characterized by primary commodity exports and manufactured goods imports, a pattern associated with economic underdevelopment and vulnerability to external shocks *(Xing–Xu 2014)*. Primary commodities, such as agricultural products and raw materials, generate lower and more volatile earnings compared to manufactured goods due to price fluctuations, weather-related disruptions, and external shocks. Consequently, countries heavily reliant on primary commodity exports often experience chronic trade deficits and struggle to accumulate sufficient foreign reserves to finance essential imports. furthermore, purely the geography based nature *Gogebakan (2025)* estimates the impact of trade on income over a two-decade period and finds that trade elasticity of income is positive, indicating that an increase in trade leads to a proportional rise in income on average.

Despite extensive research on trade-growth linkages, the tripartite relationship between international trade, domestic savings, and economic growth remains underexplored, particularly in country-specific analyses. Prior studies *(Alguacil et al., 2004; Barro 1991; Coskuner–Olasehinde-Williams, 2017; Liu–Ma, 2022; Romm, 2005)* emphasize the significance of savings in facilitating investment and growth. A heavy reliance on imports can suppress domestic investment, discourage technological advancement, and limit a country's movement up the global value chain. Institutional quality and government policies also shape the trade-savings-growth nexus, as demonstrated by the industrialization strategies of China, Japan, and South Korea *(Xing–Xu 2014)*. Ethiopia, however, remains

predominantly agriculture-based, with limited export diversification and low domestic savings rates.

Ethiopia presents a compelling case study to examine the intricate dynamics between trade, savings, and growth. Between 1992 and 2023, the country experienced high growth rates and infrastructural expansion, largely driven by its Growth and Transformation Plans (GTP I and II). However, structural challenges persist, including an agriculture-dependent economy, low domestic savings, persistent trade deficits, and susceptibility to external shocks. In 2022, Ethiopia's gross domestic savings as a % of GDP stood at 15.26%, significantly below the Sub-Saharan African (SSA) average, while its trade deficit reached $3.29 billion in Q1 2023 *(UNDP, 2024)*. These structural imbalances necessitate a closer investigation into the dynamic interactions among trade, savings, and growth.

The theoretical framework for this study is grounded in the endogenous growth model *(Romer, 1990; Lucas 1988)*, which underscores the role of investment in physical and human capital, technological progress, and policy-induced structural transformation. The savings-investment nexus is crucial for capital accumulation and industrialization, while trade openness facilitates access to global markets and technology *(Goldberg–Maggi, 1999)*. Furthermore, *Thirlwall's law (1979)* provides an important macroeconomic perspective on balance-of-payments constraints, highlighting how variations in income elasticities of exports and imports contribute to uneven development *(Trigg, 2020)*. Ethiopia's dependence on primary commodities and manufactured goods imports reflects this classical "commodity trap," constraining long-term growth due to trade volatility and external deficits.

While previous studies have examined trade-growth relationships by neglecting the causal analysis of trade-saving-growth nexus together, this study contributes to the literature by contextualizing these dynamics within Ethiopia's unique socio-economic and policy environment. Specifically, it seeks to analyse the dynamic relationships between international trade, domestic savings, and economic growth using *Toda and Yamamoto (1995)* approach of a multivariate vector autoregressive (VAR) causality test.

This study seeks to provide empirical insights that inform policy strategies for the Ethiopian economy by examining key interdependencies specific to the country. It addresses existing research gaps by incorporating Ethiopia's unique economic complexities, particularly its reliance on agricultural exports, significant demand for manufactured goods imports, a negative trade balance, and vulnerability to external shocks. Additionally, we evaluate both external determinants, such as UNCTAD commodity prices and trade shocks, and institutional factors such as government effectiveness index, to understand their collective impact on the trade-growth-savings nexus. The motivation for focusing

on Ethiopia is underscored by its status as a low-income country undergoing structural transformation. The nation's initiatives aimed at industrialization, exemplified by investments in industrial parks and export-oriented sectors, provide a unique framework for analysing the conditions under which trade and savings can contribute to economic growth while addressing the challenges posed by high inflation, foreign exchange shortages, and persistent trade imbalances.

This study attempts to answer research questions of how does the relationship among international trade, domestic savings, and economic growth in Ethiopia evolve?

In this paper, we present an alternative perspective on the trade-savings-growth relationship in Ethiopia for the period 1992Q1–2023Q4. Therefore, this paper examines the trade-savings-growth nexus in Ethiopia from 1992Q1–2023Q4. We hypothesize that trade drives economic growth, with domestic savings channeling trade gains into investment. However, trade openness and taxation influence this relationship, while macroeconomic shocks such as inflation, exchange rate volatility, and trade deficits can destabilize savings and investment.

The remainder of this paper is divided into four main sections. The next section reviews the relevant literature, including theoretical and empirical studies. The third section explains the materials, methods, and model specifications used in the analysis. The fourth section presents and discusses the results of the analysis. The final section presents our conclusion and recommendations.

1. Methodology

1.1 Research design

Since simultaneity exists among economic variables, they should be treated symmetrically without imposing a priori distinctions between endogenous and exogenous variables *(Sims 1980; Sims et al. 1990)*. However, conventional asymptotic theory is inapplicable to hypothesis testing in levels VAR models when variables are integrated or cointegrated *(Toda–Yamamoto, 1995)*. To address this, we employ a Multivariate Vector Autoregressive (VAR) model using the *Toda and Yamamoto (1995)* causality approach to analyze the dynamic relationships between trade, savings, and economic growth in Ethiopia over the period 1992Q1–2023Q4. This method allows for robust causality testing without the need for pre-

tests of stationarity or cointegration, ensuring reliable inference even in the presence of integrated processes.

The traditional Granger causality tests can mislead when variables exhibit unit roots or cointegration, leading to issues of spurious regression or incorrect inference. The Toda and Yamamoto procedure circumvents these issues by augmenting the VAR model with adding lags dmax, ensuring the asymptotic of the Wald test remains valid even in the presence of integrated or non-stationary series. This critical economic studies where macroeconomic variables often exhibit stochastic trends and structural breaks over long time horizons *(Lütkepohl, 2006)*. Given the complexity of trade-growth-savings interaction, where feedback loops and endogeneity are common, the Toda and Yamamoto approach provides a more reliable framework for causal inference compared to standard VAR models, which may suffer from bias due to pre-testing *(Hacker–Hatemi-J., 2006)*. Finally, 1992 was chosen as the starting period of the study because it marked the beginning of Eritrea's separation from Ethiopia, and the data afterwards accurately depicts Ethiopia's real macroeconomic data.

1.2 Data type, source, and analysis

This study uses the time series data covering 1992Q1 to 2023Q4, which are obtained from the World Development Indicators, Worldwide Governance Indicators, the International Monetary Fund, the United Nations Conference on Trade and Development, and US Federal Reserve Data.

We use several indicators to support a comprehensive investigation. Trade as a proportion of GDP, Gross domestic savings (GDS), Foreign direct investment (FDI), official exchange rate (EX), consumer price index (CPI), and government effectiveness (GEE) are among the indicators considered. Referring to total merchandise trade as a proportion of GDP is one technique used to quantify the impact of international trade on economic growth. This variable provides a figurative example of how Ethiopia’s trade openness and international trade capabilities can significantly impact the nation’s economic growth, revealing how trade pattern changes impact economic growth and how savings and economic growth interact.

We contend that countries can benefit from FDI and other capital inflow attributable to international trade, both of which have an impact on domestic savings rates and economic growth. Another crucial metric for assessing the competitiveness of a country’s imports and exports is its official exchange rate. Changes in the exchange rate can affect trade volume and patterns by raising or lowering the cost of imports and exports. Furthermore, variations in the average

prices of goods and services over time are proxied by CPI, which is a measure of inflation. Because inflation affects purchasing power, investment choices, and general macroeconomic stability, it can have a major impact on trade, domestic savings, and economic growth. To understand the shocks of external factors we include the UNCTAD commodity price maybe influence the international trade trend of Ethiopia.

Finally, evaluating the contribution of institutional quality and governance to economic development requires considering the government's effectiveness; therefore, we included this variable in our study to determine how institutional quality influences the interplay between international trade, domestic savings, and economic growth. Table 1 presents an overview of the significant factors and sources from which the indicators used in the research are obtained.

Table1

Lists the data sources and measurements

Variable	Define and measure	Sources of data
LNGDP	Gross domestic product at current US$ in billion	World Bank world development indicators
LNGDS	Gross savings (% of GDP): Gross savings are calculated as gross national income less total consumption, plus net transfers.	World Bank national accounts data
LNDEBT_STO	External debt stocks, short-term (current US$)	
LNEXP_GDP	Government expense (% of GDP)	
LNGOV_REV	Government revenue, excluding grants (% of GDP)	
LNTRADE	Trade (US_current_price (millions): is the sum of merchandise export and import	UNCTADstat
LNEXP	Exports US$ at current prices in millions	
LNIM	Import US$ at current prices in millions	
LNTOP	Trade openness is measured as the sum of a country's exports and imports as share of the country GDP in % (m+x/GDP)	
LNEX	Official exchange rate is determined by national authorities. It is calculated as an annual average based on monthly average local currency unit relative to the U.S.dollar (LCU per US$, period average)	World Bank world development indicators
Pop	Population growth in %: Annual population growth rate for year t is the exponential rate of growth of midyear population from year t–1 to t, expressed as a percentage. Population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship.	
LNTAX-INTL	Taxes on international trade (% of revenue) includes import duties, export duties, profits of export or import monopolies, exchange profits, and exchange taxes	

(Table continues on the next page.)

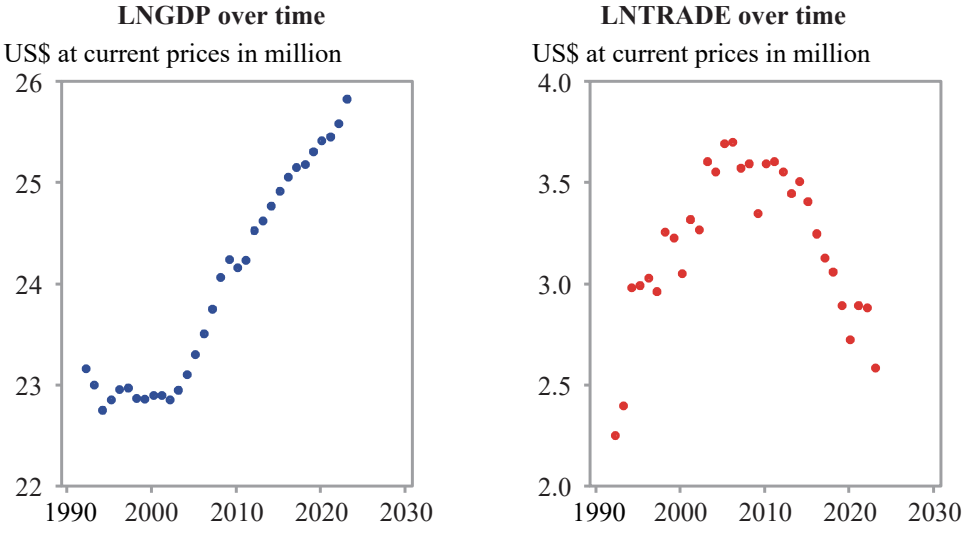
(Continued.)

Variable	Define and measure	Sources of data
lnFDI	Foreign direct investment refers to direct investment equity flows in the reputing economy. It is the sum of capital, reinvestment of earnings, and other capital measured by net inflows (BoP, current US$)	World Bank global-metrics www.macrotrends.net
lnGEE	Government Effectiveness(lnGEE) Refers to the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies. (lnGEE) = 0 indicates poor = 5 good	Worldwide governance indicators
CPI	Inflation, consumer prices (annual %): Inflation as measured by the consumer price index reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly. The Laspeyres formula is generally used.	World Bank development indicator

Source: author's construction.

Figure 1

Trends of gross domestic product (GDP) and trade



Source: author's construction.

Figure 1 presents the cross plots of Ethiopian gross domestic product (GDP) and trade as a percentage of GDP. In 1992, Ethiopian GDP experienced a decline due to the prolonged civil war in the 1980s, recurrent droughts, and ineffective centrally planned economic policies. Specifically, GDP growth fell to zero in 1990, resulting in negative growth by 1992, driven by slow export growth, a deteriorating trade position, and foreign exchange shortages that limited domestic saving and investment to 3–5% and 10–15% of GDP, respectively *(WB, 2009)*. However, trade's contribution to GDP increased until 2007, forming a parabolic or inverted U-shape trajectory through 2023.

The economic downturn in Ethiopia during 1992 can be attributed to a 23% decline in government expenditure and a 12% decrease in government revenues, which limited the growth of reserve money (M1 and M2). Consequently, the share of GDP from these reserves rose from 15% and 21% in 1997 to 51% and 68% in 1992, contributing to inflation and a budget deficit *(IMF, 2009)*. Additionally, the negative current account deficit indicated government dissaving, as non-capital expenditures exceeded non-capital revenues. A negative cyclical adjustment budget suggested that contractionary fiscal policies outweighed expansionary measures, hindering economic recovery.

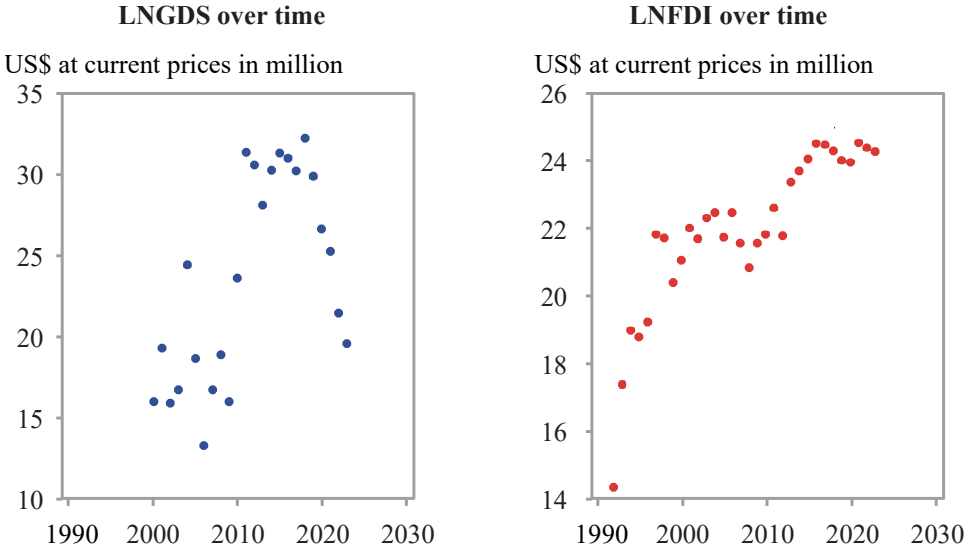
The average per capita GDP was a mere $207 in 1992, categorizing Ethiopia as a low-growth economy with insufficient savings. Reforms initiated in 1992, including the Agricultural Development-Led Industrialization (ADLI) strategy, aimed to enhance agricultural productivity and promote industrial growth to alleviate poverty *(IMF, 2009)*. These reforms were followed by the Growth and Transformation Plan I (GTP I) from 2010 to 2015, which yielded significant economic changes through trade policy liberalization, including tariff reductions and improved market access via regional agreements like the Common Market for East and South Africa (COMESA).

Ethiopia, benefiting from a surge in world coffee prices in 1995, faced challenges post-AGOA inclusion in 2000 when trade as a percentage of GDP initially increased *(IMF, 2009)*. However, the 2022 withdrawal from AGOA negatively impacted export trends *(AGO, 2024)*. Since 2007, Ethiopia's trade contribution to GDP has declined significantly, largely due to a narrow export base reliant on agricultural products sensitive to global price fluctuations and adverse weather. The economic impact of Covid-19 and the Russia–Ukraine conflict has further exacerbated this decline in trade contribution.

As we see from Figure 2 below, presents the cross plots of domestic savings and foreign direct investment flows in relation to domestic income.

Figure 2

Trends of gross domestic saving and foreign direct investment in relation to domestic income (in real long-term)



Source: author's construction.

Ethiopia has encountered significant challenges in enhancing domestic savings, primarily due to a historically low savings rate that hampers capital accumulation and economic growth *(Mirach–Hailu, 2014)*. Figure 2 illustrates a positive correlation between savings and foreign direct investment (FDI), with a pronounced relationship between savings and income. This correlation is echoed in the savings-GDP cross-relation (see in Annex Figure A1). However, it is essential to note that correlation does not imply causation, leaving open the debate about the savings-growth nexus direction. Theoretical frameworks, such as the Solow growth model *(Solow, 1956)*, suggest that domestic savings are essential for economic activities, while economic growth can simultaneously influence saving behaviour. Furthermore, increased domestic income may signal higher expected profits, thereby attracting new foreign investment opportunities.

1.3 Model specification, estimation techniques, and procedures

We identified several variables that are crucial for understanding the relationships between trade, saving, and economic growth (See Table 1). These variables are closely linked and have been widely applied in previous research. Specifically, we

use the endogenous variables gross domestic product (LNGDP), international trade (indexed by trade openness (LNTOP)), Gross domestic saving (LNGDS), tax on international trade (LNTAX_INTL), government expenditure (LNEXP_GDP), External debt stocks, short-term (LNDEBT_STO), government revenue (LNGOV_REV), and the exogenous variables consumer price index (CPI), foreign direct investment (LNFDI), population (pop), the quality of institutions (measured by government effectiveness (LNGEE)), UNACTAD commodity price (LNUNCTAD_COM_PRICE), and official exchange rate (LNEX).

The empirical analysis of the relationship between trade, savings, and growth is based on endogenous growth theory, specifically the augmented Solow (1956) growth model that integrates trade and savings linkages. This framework enhances the traditional Cobb-Douglas production function by including trade openness and savings as crucial determinants of long-term economic growth. The Cobb-Douglas production function

$$y_t = A_t k^{\alpha} L_t^{1-\alpha}$$

where y_t is output, A_t is total productivity (TFP), k_t is capital stock, Lt is labor, and α is capital share in output ($0 < \alpha < 1$).

The model assumes diminishing returns to capital and labor, where the marginal contribution of each additional unit of capital declines as investment increases. It also posits constant returns to scale, implying that a proportional increase in all inputs results in an equivalent increase in output. Exogenous technological progress (A_t) is identified as a critical factor for long-term growth, with savings driving capital accumulation. In an open economies, trade and savings become fundamental determinants of capital accumulation. Trade openness facilitates technology transfer, efficiency gains, and access to global markets, thereby boosting productivity and economic growth. Similarly, gross domestic savings finance capital formation, supporting long-term growth and structural transformation. Solow's fundamental capital accumulation equation is given as:

$$\dot{k}_t = sY - \delta K_t$$

where $\dot{k}$ represent the change in capital stock over time S is the savings rate and σ is depreciation. Therefore, by incorporating trade openness and saving into capital accumulation equation, we obtain. Capital accumulation in the Solow model follows the fundamental equation

$$y_t = A_t K_t^{\alpha} L_t^{1-\alpha} \mathrm{f}(lngds,\ lntop)$$

The trade-saving-growth nexus is influenced by government policy, particularly through taxes on international trade influence trade incentives and capital allocation. While government expenditures and debt levels affect infrastructure investment and fiscal sustainability. Government revenue determines the extent of public investment in growth-enhancing projects.

To account for external shocks and policy effectiveness, we incorporate control variables. Inflation impacts real investment decisions, foreign direct investment (FDI) supplement domestic savings and capital formation. Population dynamics influence labour supply and production capacity. Additionally institutional quality improves governance and economic efficiency. While commodity prices and exchange rates affect trade performance and competitiveness, respectively.
Thus, the structural basic functional form of our model is specified as:

$$\text{lngdp} = \text{f}(\text{lngds, lntop, lntax\_intl, lnexp\_gdp, lndebt\_sto, lngov\_re, lncpi, lnfdi, lnpop, lngee, lnUNCTA}D_{comprice}\text{, lnex})$$

1.4 Unit root test

Since our data was a time series, we conducted a unit root test to examine stationarity. We used augmented Dickey–Fuller (ADF) and Phillips–Perron (PP) tests, which offered the advantage of flexibility in capturing complex patterns, a rigorous hypothesis testing framework, and robustness to common data characteristics. We estimated the following ADF unit root equation:

$$\Delta y_t = \alpha_1 + \omega y_{t-1} + \alpha_2 \text{t} + \sum_{i=1}^{l} di \Delta y_{t-1} + v_t \; 2$$

where y represented the relevant time series, and Δ denoted the first-difference operation, which calculated the change between consecutive observations. a_1 represented the drift or constant term, t denoted the time trend, and l represented the lag length selected using information criterion, where $H_o : \omega = o$ (i.e., presence of unit root) and $H_1 : \omega \neq o$, (i.e., no unit root). Furthermore, we conducted tests for unit root for each variable with constant (none), constant(drift), and constant with trend (trend).

The unit root test results summarized in Table 2 below revealed that most variables were non-stationary at level across the different tests (ADF and PP) indicate that all variables were non-stationary at levels, as evidenced by the failure of both the ADF-Fisher and PP-Fisher tests to reject the null hypothesis of a unit root. However, after transforming the series into first differences, both tests consistently rejected the null hypothesis at the 1% significance level for all variables, indicating that the fist-differenced series are stationary. The results show that all variables are integrated of order one, I(1), implying that potential long-run relationship may exist among them. Consequently, the Toda and Yamamoto (1995) produce for Granger causality analysis is appropriate for examining the dynamic interrelationship among these variables.

Table 2

Unit root test result

Variable	ADF-Fisher statistic	Lag	Obs	PP-Fisher statistic	Bandwidth	Obs (Total 460)
D(LNBOP)	270.44 ***	0	30	312.94 ***	3	30
D(LNCPI)	270.44 ***	0	30	312.94 ***	10	30
D(LNDEBT_STO)	270.44 ***	0	30	312.94 ***	10	30
D(LNEXCH)	270.44 ***	0	30	312.94 ***	2	30
D(LNEXP)	270.44 **	0	30	312.94 **	3	30
D(LNEXP_GDP)	270.44 ***	0	30	312.94 ***	9	30
D(LNFDI)	270.44 ***	0	30	312.94 ***	2	30
D(LNGDP)	270.44 **	0	30	312.94 *	4	30
D(LNGDS)	270.44	2	20	312.94 **	11	22
D(LNGEE)	270.44	1	25	312.94 ***	2	26
D(LNGOV_REV)	270.44 **	0	30	312.94 **	1	30
D(LNIM)	270.44 ***	0	30	312.94 ***	3	30
D(LNPOP)	270.44 **	2	28	312.94 ***	9	30
D(LNTAX_INTL)	270.44 ***	0	30	312.94 ***	29	30
D(LNTRADE)	270.44 ***	0	30	312.94 ***	2	30
D(LNUNCTAD_COM_PRICE)	270.44 ***	0	27	312.94 ***	10	27

Note: * = 10%, ** = 5%, *** = 1% significance level.

We applied Akaike and Schwarz methods for lag length selection, utilize Bartlett's lag limits kernel method, and employ Newey–West bandwidth. The lag selection criteria to determine the optimal lag, as illustrated in Table 3 below. These criteria include log likelihood, likelihood ratio (LR), final prediction error (FPE), Akaike information criterion (AIC), Hannan–Quinn (HQ), and the Schwarz Bayesian information criterion at the 5% level of significance.

Table 3

VAR Lag-order selection criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	152.1801173243505	NA	1.33e-05	–2.715114	–1.881844*	–2.379090
1	152.1808816987128	0.001308	1.63e-05	–2.515131	–1.431880	–2.078300
2	152.1822875442082	0.002312	2.00e-05	–2.315162	–0.981930	–1.777525
3	152.1855515731066	0.005150	2.47e-05	–2.115234	–0.532022	–1.476790
4	212.3070621453953	90.85028*	8.01e-06*	–3.251268*	–1.418074	–2.512017*
5	212.3075811736623	0.000750	9.93e-06	–3.051280	–0.968105	–2.211221

* Indicates lag order selected by the criterion (each test at 5% level).
Endogenous variables : D_LNGDP D_LNGDS D_LNTRADE.
Exogenous variables : C D_LNCPID_LNFDID_LNPOPD_LNGEED_LNUNCTAD_COM_PRICED_LNEX D_LNTAX_INTLD_LNEXP_GDPD_LNDEBT_STO sample : 1992Q1–2023Q4.
Included observations: 121.
Source: author's computation.

Lag 4 is chosen as optimal by LR, FPE, AIC, and HQ, as indicated by the asterisks next to the minimum values. While SC shows at level lag selection respectively. We do not choose the LogL lag selection criteria are not chosen because of their insignificance. Consequently, the VAR uses lag (4) in the model based on the minimization of the information criteria used.[1]

The general VAR structure equation, consisting of endogenous, exogenous, and other control variables, is:

$$Y_t = A_0 + \sum_{i=1}^{P} \mathrm{A_i Y_{t-i}} + \sum_{i=1}^{P} \beta_{11\mathrm{i}} \mathrm{X_{t-j}} + \sum_{i=1}^{q} \mathrm{C_k Z_{t-j}} + + \epsilon_t$$

where p is the optimal number of lags for the endogenous variables $\mathrm{Y_t}$ and the exogenous variables $\mathrm{X_t}$[2]; Y_t is a vector of endogenous variables that, $Y_t = (LNGDP,\ LNGDS,\ LNTOP)'$, X_t is a vector of exogeneous variables, that, $X_t = (LNEX,\ LNCPI,\ LNFDI)'$, Z_t is a vector of control variables, that

$$Z_t = \left(LNPOP,\ LNDEB_{STO},\ LNTAX_{INTL}, LNBoP,\ LNEXP,\ LNUNCTAD_{COM_{PRICE}}, LNGEE\right)'$$

where ϵ_{it} is a vector of error terms.

Augmented Toda–Yamamoto expanded VAR equations for endogenous variables are

$$\mathrm{LNGDP_t} = \beta_{10} + \sum_{i=1}^{5} \beta_{11\mathrm{i}} \mathrm{LNGDP_{t-i}} + \sum_{i=1}^{5} \beta_{12\mathrm{i}} \mathrm{LNGDS_{t-i}} + \sum_{i=1}^{5} \beta_{13\mathrm{i}} \mathrm{LNToP_{t-i}} + \sum_{i=1}^{5} \beta_{14\mathrm{i}} FDI_{\mathrm{t-i}} + \sum_{k=0}^{1} \gamma_{11} Z_{t_k} + \epsilon_{1\mathrm{t}}$$

$$\mathrm{LNGDS_t} = \beta_{20} + \sum_{i=1}^{5} \beta_{21\mathrm{i}} \mathrm{LNGDP_{t-i}} + \sum_{i=1}^{5} \beta_{22\mathrm{i}} \mathrm{LNGDS_{t-i}} + \sum_{i=1}^{5} \beta_{23\mathrm{i}} \mathrm{LNToP_{t-i}} + \sum_{i=1}^{5} \beta_{24\mathrm{i}} FDI_{\mathrm{t-i}} + \sum_{k=0}^{1} \gamma_{21} Z_{t_k} + \epsilon_{2\mathrm{t}}$$

$$\mathrm{LNToP_t} = \beta_{30} + \sum_{i=1}^{5} \beta_{31\mathrm{i}} \mathrm{LNGDP_{t-i}} + \sum_{i=1}^{5} \beta_{32\mathrm{i}} \mathrm{LNGDS_{t-i}} + \sum_{i=1}^{5} \beta_{33\mathrm{i}} \mathrm{LNToP_{t-i}} + \sum_{i=1}^{5} \beta_{34\mathrm{i}} FDI_{\mathrm{t-i}} + \sum_{k=0}^{1} \gamma_{31} Z_{t_k} + \epsilon_{3\mathrm{t}}$$

where $\beta_{10},\ \beta_{20},\ and\ \beta_{30}$ are intercept where as β_{jki} is the interceptions of the lags for the endogenous variables, and $\gamma_{11k}$is the coefficient of the control variables.

[1] From VAR lag selection the optimal lag (P), p = 4, the maximum order of integration (d_{max}), d_{max} = 1 as variables are I (1), and therefore total lag for Toda and Yamamoto were $p+d_{max}$ which is equal to 1+4 = 5.

[2] We used AIC, SC, HQ, and LR criteria to selct P lag for VAR the model

Augmented Matrix of the VAR model

$$LNGDP_t = \beta_{n0} + \sum_{i=1}^{p+d} [\beta_{11i} \quad \beta_{12i} \quad \beta_{13i} \quad \beta_{14i}] \begin{bmatrix} LNGDP_{t-i} \\ LNGDS_{t-i} \\ LNToP_{t-i} \\ LNFDI_t - i \end{bmatrix} +$$

$$\sum_j^q [\gamma_{11i} \quad \gamma_{12i} \quad \gamma_{13i}] X_{t-j} + \epsilon_{1t}$$

$$LNGDS_t = \beta_{20} + \sum_{i=1}^{p+d} [\beta_{21i} \quad \beta_{22i} \quad \beta_{23i} \quad \beta_{24i}] \begin{bmatrix} LNGDP_{t-i} \\ LNGDS_{t-i} \\ LNToP_{t-i} \\ LNFDI_t - i \end{bmatrix} +$$

$$\sum_j^q [\gamma_{21i} \quad \gamma_{22i} \quad \gamma_{23i}] X_{t-j} + \epsilon_{2t}$$

$$LNToP_t = \beta_{30} + \sum_{i=1}^{p+d} [\beta_{31i} \quad \beta_{32i} \quad \beta_{33i} \quad \beta_{34i}] \begin{bmatrix} LNGDP_{t-i} \\ LNGDS_{t-i} \\ LNToP_{t-i} \\ LNFDI_t - i \end{bmatrix} +$$

$$\sum_j^q [\gamma_{31i} \quad \gamma_{32i} \quad \gamma_{33i}] X_{t-j} + \epsilon_{3t}$$

Then finally the augmented VAR matrix can be represented as.

$$\begin{bmatrix} LNGDP_t \\ LNGDS_t \\ LNToP_t \end{bmatrix} = \beta_{10} + \sum_{i=1}^{p+d} \begin{bmatrix} \beta_{11i} & \beta_{12i} & \beta_{13i} & \beta_{14i} \\ \beta_{21i} & \beta_{22i} & \beta_{23i} & \beta_{24i} \\ \beta_{31i} & \beta_{32i} & \beta_{33i} & \beta_{34i} \end{bmatrix} \begin{bmatrix} LNGDP_{t-1} \\ LNGDS_{t-1} \\ LNToP_{t-1} \\ LNFDI_{t-1} \end{bmatrix} + \sum_{j=0}^{q} \begin{bmatrix} \gamma_{11j} \\ \gamma_{21j} \\ \gamma_{31j} \end{bmatrix} X_{t-j} + \begin{bmatrix} \epsilon_{1t} \\ \epsilon_{2t} \\ \epsilon_{3t} \end{bmatrix}$$

2. Results

Table 4 below shows the descriptive statistics for Ethiopia's GDP, savings, and trade openness from 1992 to 2023 indicate key economic characteristics. The natural logarithm of GDP (LNGDP) has a mean of 23.928 and a median of 23.863, with a standard deviation of 1.0603, revealing moderate variability and stable economic growth.

Table 4

Summary statistics for LNGDP, LNGDS, and LNToP*

Variable	Mean	Median	Standard deviation	Skewness	Kurtosis
LNGDP	23.928	23.863	1.0603	0.292	1.54
LNGDS	21.550	18.839	6.5760	0.454	1.56
LNToP	0.648	0.671	0.0616	–0.599	2.06

* We described trade openness in the descriptive statistics, as it clearly indicates relationships and variations. So far, trade as a percentage of GDP shows similar characteristics.
Source: author's computation.

A slight positive skewness (0.292) suggests infrequent extreme high values, while a low kurtosis (1.54) indicates a taller distribution, reflecting sustainable development potential.

In contrast, the natural logarithm of savings (LNGDS) shows a mean of 21.550 and a median of 18.839, indicating low savings levels relative to GDP. The high standard deviation (6.5760) signifies substantial fluctuations in saving patterns, with a positive skewness (0.454) and low kurtosis (1.56), suggesting diverse savings behaviours potentially influenced by economic shocks and varying policies. For trade openness (LNToP), the mean is 0.648 with a median of 0.671 and a low standard deviation (0.0616), reflecting stable trade participation. However, negative skewness (–0.599) indicates possible declines in trade openness due to barriers or external shocks, with a kurtosis of 2.06 indicating moderate tail behaviour. Overall, the statistics illustrate steady economic growth, volatile savings behaviour, and consistent trade openness, highlighting the need for policy interventions to enhance savings rates and economic resilience.

The correlations between economic growth, domestic savings, and international trade (trade openness) are high. Table 5 below shows strong and statistically significant relationship between GDP, savings, and trade openness. The correlations are relatively significant through many of them.

Table 5

Correlation matrix

Variable	LNGDP	LNGDS	LNToP
LNGDP	1.00	0.73***	0.85***
LNGDS	0.73***	1.00	0.75***
LNToP	0.85***	0.75***	1.00

Note: N = 32. * Indicates P < 0.1, ** indicates P < 0.05, *** indicates P < 0.01.
Source: author's computation

Specifically, LNGDP is highly correlated with LNToP (0.85) and LNGDS (0.73) suggesting that economic growth in Ethiopia is closely associated with both domestic savings and trade openness. Similarly, LNToP shows a strong positive correlation with LNGDS (0.75), indicating that increased trade activities are associated with higher domestic savings.

2.1 Cointegration test

To examine the long-run equilibrium relationships among savings, trade, and economic growth in Ethiopia, the *Johansen (1991)* cointegration test was employed explained in Table 6 below. Following the methodology of *Kitamura*

(1998), a lag structure of 1 to 5 in first differences was included. Both the trace and maximum eigenvalue tests reject the null hypothesis of no cointegration at the 5% significance level, indicating the presence of two cointegrating relationships among the three variables. Specifically, the trace statistics for H0: r = 0 and H0: r ≤ 1 are statistically significant (p < 0.05), whereas H0: r ≤ 2 is not, confirming that at most two cointegrating equations exist.

Table 6

Johansen cointegration test

Hypothesis	Eigenvalue	Statistic	Critical value (5%)	p-value	Maximum eigenvalue statistic (λmax)	5% critical value	p-value
r = 0	0.5251	92.819	29.797	0.000*	67.022	21.132	0.000*
r ≤ 1	0.2389	25.797	15.495	0.001*	24.566	14.265	0.001*
r ≤ 2	0.0136	1.231	3.841	0.267	1.231	3.841	0.267

Note: * indicates significance at the 5% level.
Source: author's computation.

The maximum eigenvalue statistics corroborate the trace test results, confirming a stable long-term equilibrium among economic growth, trade, and savings. These findings imply that policy shocks to one variable will exert lasting and predictable effects on the others. The existence of cointegration also justifies estimating a Vector Autoregression (VAR) model to analyze short-run dynamics consistent with *Johansen (1995)*. Moreover, the cointegration results validate the applicability of the Toda–Yamamoto modified Wald (MWALD) procedure for Granger causality analysis, allowing inference on both short-run and long-run directional relationships among the variables[3].

2.2 VAR result

The short-run dynamics of the VAR estimates demonstrate strong persistence in economic growth (see Table 7), as the coefficient of D_LNGDP (–4) is highly significant and positive (1.033, t = 12.2142), indicating that past GDP strongly predicts current GDP. This suggests a self-reinforcing growth mechanism driven

[3] While the estimation of Vector Error Correction Models (VECMs) is appropriate for examining long-run relationships among cointegrated macroeconomic variables, our primary objective is to assess the causal relationships between growth, trade, and domestic savings within the Ethiopian economy. Consequently, our analysis will be confined to a Vector Autoregression (VAR) model, followed by causality testing using the approach established by *Toda and Yamamoto* in 1995.

by accumulated capital, improved productivity, and economic momentum, consistent with *Barro and Sala-i-Martin (2004)* on economic convergence.

However, D_LNGDP(–4) is negatively associated with trade (–0.402, t = –2.46), potentially reflecting fiscal and trade policy constraints. For instance, the negative and significant coefficient of D_LNTAX_INTL (–0.240, t = –8.76) indicates a domestic demand effect, where an increase in GDP raises imports of consumption goods and reduces export supply or competitiveness due to real exchange rate appreciation. Similarly, the negative association between GDP and savings (–17.189, t = –2.59) suggests that past economic growth has been consumption-driven, limiting both export competitiveness and the capacity for domestic saving. This pattern reflects Ethiopia's structural condition, where much of household income is devoted to essential consumption such as food and shelter, leaving limited scope for savings accumulation.

While the effect of gross domestic savings (D_LNGDS) on D_lnGDP was found to be statistically significant in the short-run with coefficient 0.005 t-values (2.648), indicating that domestic savings significantly influence short-term economic growth. Contradictory, some current findings of *Mohammadzaheh and Refah-Kahriz (2023)*, who suggested that savings negatively impact GDP due to their contribution to speculative practices in the land and housing markets, which inflate housing prices and lead to increased inflation rather than investment, thereby reducing national output. *Elie (2024)* further notes that political instability and civil conflict undermine foreign direct investment and decrease domestic savings, contributing to a decline in the availability of loanable funds for investment

We also find that FDI and GDP in Ethiopia were negatively associated in past trends (coefficient of FDI = -0.036, t = -3.095), but FDI was positively associated with trade (0.036, t = 1.594) and savings (1.133, t = 1.229). This indicates the heterogeneous transmission of macroeconomic shocks, with FDI supporting trade and savings in Ethiopia.

Importantly, debt stock constrains GDP growth, with a coefficient of D_LNDEBT_STO = -0.08 (t = –6.711), as debt service increases government expenditures, which are negatively related to GDP (D_LNEXP_GDP = –0.185, t = –4.929). However, such spending may encourage trade and savings, reflecting government allocations that support trade facilitation and household savings.

The model fit is strong for GDP and trade, with R-squared values of 0.927 and 0.721, respectively, while savings shows lower explanatory power (R-squared = 0.318). The overall model is statistically significant for GDP and trade (F-statistics: 41.423 and 8.499, respectively). The AIC and SC values indicate that the model specification is appropriate.

Table 7

Vector autoregression (VAR) estimates

Variables	D_LNGDP	D_LNTRADE	D_LNGDS
D_LNGDP(–1)	0.000	0.004	–0.041
	0.041	0.079	3.206
	[–0.00112]	[0.05667]	[–0.01272]
D_LNGDP(–2)	0.000	0.004	–0.041
	0.041	0.079	3.206
	[–0.00112]	[0.05667]	[–0.01272]
D_LNGDP(–3)	0.000	0.004	–0.041
	0.041	0.079	3.206
	[–0.00112]	[0.05667]	[–0.01272]
D_LNGDP(–4)	1.033	–0.402	–17.189
	0.085	0.163	6.639
	[12.2142]	[–2.46031]	[–2.58899]
D_LNTRADE(–1)	0.000	0.001	–0.007
	0.034	0.066	2.689
	[–0.00024]	[0.01198]	[–0.00269]
D_LNTRADE(–2)	0.000	0.001	–0.007
	0.034	0.066	2.689
	[–0.00024]	[0.01198]	[–0.00269]
D_LNTRADE(–3)	0.000	0.001	–0.007
	0.034	0.066	2.689
	[–0.00024]	[0.01198]	[–0.00269]
D_LNTRADE(–4)	0.303	–0.239	–0.555
	0.045	0.087	3.519
	[6.75616]	[–2.76106]	[–0.15763]
D_LNGDS(–1)	0.000	0.000	0.000
	0.001	0.003	0.102
	[–0.00016]	[0.00834]	[–0.00187]
D_LNGDS(–2)	0.000	0.000	0.000
	0.001	0.003	0.102
	[–0.00016]	[0.00834]	[–0.00187]
D_LNGDS(–3)	0.000	0.000	0.000
	0.001	0.003	0.102
	[–0.00016]	[0.00834]	[–0.00187]
D_LNGDS(–4)	0.005	0.003	–0.093
	0.002	0.003	0.134
	[2.64864]	[0.81829]	[–0.68799]
C	0.000	–0.001	0.008
	0.005	0.009	0.383
	[0.00181]	[–0.09146]	[0.02053]

(Table continues on the next page.)

(Continued.)

Variables	D_LNGDP	D_LNTRADE	D_LNGDS
	0.036	0.057	–0.685
D_LNCPI	0.008	0.015	0.617
	[4.53964]	[3.76141]	[–1.10960]
	–0.036	0.036	1.133
D_LNFDI	0.012	0.023	0.922
	[–3.09503]	[1.59380]	[1.22867]
	0.516	–1.473	40.666
D_LNPOP	0.495	0.957	38.853
	[1.04334]	[–1.53984]	[1.04667]
	–0.008	0.074	2.197
D_LNGEE	0.035	0.068	2.746
	[–0.21759]	[1.10007]	[0.80012]
	–0.014	0.204	–1.133
D_LNUNCTAD_COM_PRICE	0.025	0.048	1.935
	[–0.57151]	[4.29183]	[–0.58566]
	–0.138	0.283	12.707
D_LNEX	0.051	0.098	3.979
	[–2.73135]	[2.89141]	[3.19329]
	–0.240	0.087	–2.919
D_LNTAX_INTL	0.027	0.053	2.150
	[–8.76331]	[1.65091]	[–1.35774]
	–0.185	–0.030	6.047
D_LNEXP_GDP	0.037	0.072	2.939
	[–4.92955]	[–0.41397]	[2.05712]
	–0.081	0.066	–0.617
D_LNDEBT_STO	0.012	0.023	0.952
	[–6.71141]	[2.80518]	[–0.64827]
R-squared	0.927	0.721	0.318
Adj. R-squared	0.904	0.636	0.110
F-statistic	41.423	8.499	1.532
Log likelihood	224.371	164.351	–172.711
Akaike AIC	–4.448	–3.129	4.279
Schwarz SC	–3.841	–2.522	4.886

Note: sample (adjusted): 1993Q2 2023Q4, t-statistics in parenthesis Included observations: 122 after adjustments.
Source: author computation.

Mechanisms

1. Market access and export expansion channels

Trade expands a country's access to international markets, enabling domestic firms to expand exports. This expansion leads to economies of scale, improving productivity, and increased revenue, thereby stimulating economic growth. *Binici et al. (2012)* demonstrated that trade openness mitigates inflation through market competitiveness and productivity gains. *Kong et al. (2021)* noted that trade openness positively impacts the quality of economic growth with regional heterogeneity and non-linear threshold characteristics. *Raghutla (2020)* found a considerable long-run elasticity between trade openness and economic growth, while Sghaier (2023) identified a positive association between trade openness and economic growth through export promotion and financial development in four North African countries.

2. Global market condition channels

The global market conditions, represented by changes in UNCTAD commodity prices (D_LNUNCTAD_COM_PRICE), is negatively associated with Ethiopia's GDP (coefficient: –0.014, t = –0.57) and savings (coefficient: –1.133, t = –0.59), though these effects are statistically insignificant. This suggests that external price shocks exert a weak but negative influence on Ethiopia's macroeconomic indicators, primarily through trade and income channels.

2.3 Diagnostic test

2.3.1 VAR stability test

To ensure the stability of the VAR estimates, we conducted a stability analysis, where the characteristic roots indicated that all modulus values remained within the unit circle summarized in Table 8 below. This confirmed the model's stability *(Lütkepohl, 2005)*, implying dynamic stability without explosive behavior and ensuring valid inference and reliable forecasting *(Hamilton, 2020)*.

The presence of complex roots suggested cyclical behavior in the time series, consistent with the economic dynamics observed in trade and savings *(Sims, 1980)*. Thus, the findings concluded that the estimated VAR model satisfied the stability conditions, affirming the robustness of the specification.

Table 8

Rotes of characteristic polynomial

Root	Modulus	Root	Modulus
–0.891969	0.891969	0.492455	0.492455
–6.23e–05 – 0.891784i	0.891784	0.000285 – 0.491917i	0.491918
–6.23e–05 + 0.891784i	0.891784	0.000285 + 0.491917i	0.491918
0.889545	0.889545	–0.491557	0.491557
–0.513806 – 0.513026i	0.726080	0.005058	0.005058
–0.513806 + 0.513026i	0.726080	8.02e–17	8.02E–17
0.512265 – 0.511627i	0.724001	2.13e–18	2.13E–18
0.512265 + 0.511627i	0.724001		

Note: no root lies outside the unit circle. VAR satisfies the stability condition.
Endogenous variables : D_LNGDP D_LNGDS D_LNTRADE
Exogenous variables : C D_LNTAX_INTL D_LNPOP D_LNGOV_REV D_LNFDI D_LNEXP_GDP D_LNEX D_LNDEBT_STO D_LNCPI D_GEET D_LNUNCTAD
Lag specification: 1 5
Source: author's computation.

2.3.2 Test for heteroskedasticity

The presence of heteroskedasticity was assessed utilizing the VAR residual heteroskedasticity test *(White, 1980)*. The results presented in the following table indicated no significant heteroskedasticity, as all p-values > 0.05. This finding suggested that the null hypothesis of homoskedasticity could be accepted.

Table 9

VAR residual heteroskedasticity test (includes cross terms)

Dependent variable	R-squared	F (27,92)	Probability (Prob.)	Chi-sq (27)	Probability (Prob.)
res1 * res1	0.052151	0.187475	1.00	6.26	1.00
res2 * res2	0.078613	0.290722	1.00	9.43	1.00
res3 * res3	0.110482	0.423216	0.99	13.26	0.99
res2 * res1	0.006778	0.023254	1.00	0.81	1.00
res3 * res1	0.057052	0.206161	1.00	6.85	1.00
res3 * res2	0.024674	0.086202	1.00	2.96	1.00

Note: sample: 1992Q1 2023Q4, Included observations: 122
Source: author's computation.

2.4 Toda–Yamamoto test for multivariate Granger causality

In Table 9, we present the findings from the Toda–Yamamoto Granger causality test conducted to examine the interrelationships among trade dynamics (D_LNTRADE), domestic savings (D_LNGDS), and economic growth (D_LNGDP). The direction of causality among the variables is summarized in the table below.

Table 10

Toda and Yamamoto summary of granger causality results

Dependent variable	Excluded	Chi-sq	df	Prob.	Causal direction
D_LNGDP	D_LNGDS	6.070755	5	0.2994	No causality
	D_LNTRADE	32.48702	5	0.0000	Trade →GDP
	All	41.65142	10	0.0000	
D_LNGDS	D_LNGDP	0.050821	5	1.0000	No causality
	D_LNTRADE	0.078572	5	0.9999	No Causality
	All	0.088090	10	1.0000	
D_LNTRADE	D_LNGDP	37.47680	5	0.0000	GDP→Trade
	D_LNGDS	0.011112	5	1.0000	
	All	37.47817	10	0.0000	

Note: null hypothesis: series does not cause. Sample: 1992Q1 2023Q4, included observations: 122; VAR Granger Causality/Block Exogeneity Wald Tests
Source: author's computation.

The results of the Granger Causality test indicated that the null hypothesis, which posits that economic growth does not Granger-cause trade was rejected, as evidenced by (p-value = 0.00). This finding suggested that trade (D_LNTRADE) significantly Granger-caused economic growth (D_LNGDP) at the 1% significance level (p-value = 0.00). Such results provided strong evidence of the reciprocal influence between trade and GDP growth over time, indicating bidirectional causality between the two variables.

Conversely, no evidence of causality was identified between savings (D_LNGDS) and either trade or GDP, as indicated by the consistently high p-values across all tested relationships. This outcome implied that, within the studied period and model specification, savings did not play a direct role in driving economic growth or trade flows, nor were they influenced by these variables.

The findings align with prior empirical studies that highlight the critical role of trade in economic expansion, supporting the notion that increased trade activity stimulates GDP growth while economic expansion, in turn, fosters higher trade volumes. The absence of causality from savings to GDP or trade may reflect

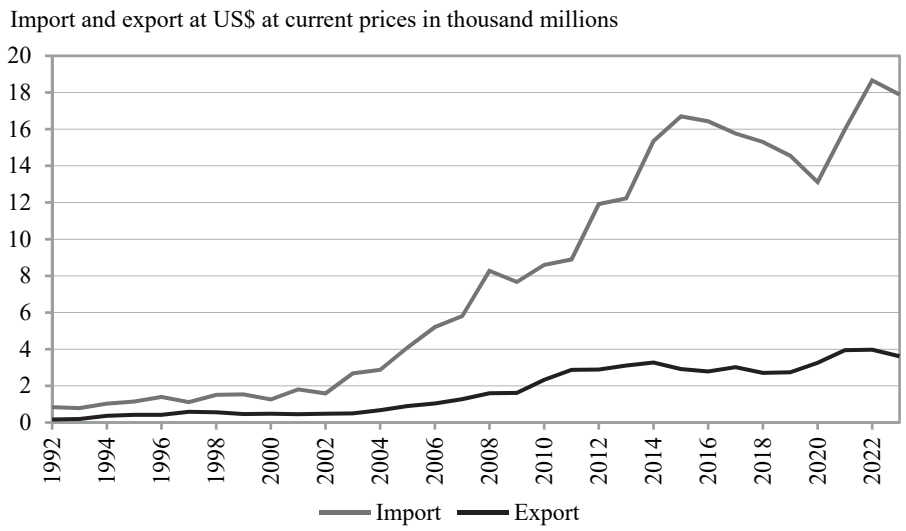
structural factors such as low financial intermediation, capital market inefficiencies, or a weak savings-investment-growth nexus in the Ethiopian context.

3. Discussion

Ethiopia's international trade, characterized by merchandise imports (MI) and exports (ME), has historically exhibited significant volatility, as depicted in below figure that the country trade is dominated by import based trade.

Figure 3

Features of international trade in Ethiopia



Source: *UNCTADstat (2025)*.

Figure 3 highlighted a persistent negative trade balance, where imports consistently exceeded exports. Over the past few decades, Ethiopian trade flows experienced both sharp increases and declines. While MI and ME demonstrated slow growth in the early years of the study, imports surged over time without a proportional rise in exports. Notably, between 2005 and 2010, an increase in MI appeared to drive a subsequent rise in ME, suggesting a long-term relationship. However, the year 2020 saw a steep decline in imports due to the disruptions caused by Covid-19.

Trade volatility was largely influenced by government trade policies, which shaped both imports and exports. As an agricultural economy, Ethiopia faced challenges when trade taxes raised input costs, potentially harming the competitiveness of its exports. Nevertheless, VAR model estimations suggested that tax reforms on international trade (D_LNTAX_INTL) were positively associated with trade (D_LNTRADE) as a percentage of GDP from 1992 to 2023. This implied that reducing trade barriers such as reforming tax policies could enhance economic openness, boost trade, and ultimately stimulate economic growth through spillover effects and technology transfers. Supporting this perspective, *Gnangnon (2019)* argued that trade openness was positively correlated with tax reform, with the impact being more pronounced in least developed countries (LDCs) like Ethiopia. This underscored the importance of strategic trade and tax policies in fostering a more dynamic and competitive trade environment.

The results of the VAR analysis (see Table 6) align with findings from previous research. The positive lagged effects of GDP indicate cross-national persistence, as noted by *Abdullahi et al. (2024)* increases in GDP continue to influence current environmental outcome, reflecting a sustained impact over time and across nations. This outcome stems from increased government spending on public infrastructure projects, which has displaced private investment. For example, the cost of the Grand Ethiopian Renaissance Dam approached $5 billion, accounting for 7% of Ethiopia's GDP in 2016. Additionally, the Covid-19 pandemic and conflicts in Ethiopia's Oromia and Tigray regions have hindered the country's GDP growth.

Cross-country data support the notion that savings positively influence economic growth *(Alguacil et al., 2004)*. Studies on trade-led growth *(Barro, 1991; Bond et al., 2011)* also confirm a small but positive effect on growth attributed to market trade (MT). Our analysis shows that international trade has statistically significant direct and indirect positive effects on Ethiopia's economic growth *(Baunsgaard–Keen, 2009)*. This reinforces the idea that trade openness can create growth opportunities, especially in developing economies like Ethiopia. The findings further indicate that international trade taxes significantly affect Ethiopia's trade openness and economic growth. We also conducted impulse response analysis, which revealed that GDP growth tends to increase following a positive tax shock before gradually declining. This suggests that changes in trade policy have nuanced effects *(Keho, 2017)*. This is consistent with literature that suggests taxes can sometimes discourage trade while simultaneously generating funds for growth-enhancing public investments.

Overall, our findings confirm the interdependence of domestic savings, international trade integration, institutional quality, and long-term sustainable

growth. For a developing country like Ethiopia, balanced policies are essential to boost savings and investment, competitively expand trade, and enhance governmental capacity to support broad-based development. Notably, Granger causality analyses provide new empirical insights into Ethiopia's economic dynamics. The bidirectional linkage between GDP and trade indicates a feedback loop, where increases in one stimulate increases in the other and vice versa. This relationship corresponds with cross-country findings regarding the interdependence of these variables *(Rasekhi et al., 2017; Xing–Xu, 2014)*.

The results also support the argument that savings rates influence trade patterns over time. Due to specific characteristics of Ethiopian trade, savings and trade exhibit a negative relationship in the short run. However, when examining long-term relationships using the Vector Error Correction (VEC) model, we find that domestic savings positively impact trade in the long run. Furthermore, variations in import and export volumes provide predictive information regarding the customs duties collected from trade taxation *(Gnangnon, 2019)*. Variance results indicate an increasing explanatory power of market trade (MT) for GDP *(Alam et al., 2017)* suggesting deeper real sector integration over time. However, the unique finding that trade openness predicts subsequent trade taxation levels implies that Ethiopia's challenges in trade competitiveness may limit the expected positive correlation between openness and tax revenue observed elsewhere.

4. Conclusion

The Toda–Yamamoto approach of causality analysis of trade-savings, and economic growth in Ethiopia reflects overviews of Ethiopian economic characteristics from large descriptions in terms of those selected variables under investigation. The main motive for this study is that, while considerable research has focused on the individual impacts of trade and savings on economic growth, the nuanced interactions among these three variables especially within the context of developing countries remain insufficiently analysed. Using the Toda–Yamamoto causality test approach, we systematically examined quarterly data from 1992 to 2023. Our findings reveal compelling evidence of a significant bidirectional relationship between trade and economic growth measured by real GDP US$ at current price. This illustrates that economic expansion in turn fosters increased trade volumes. However, we also discovered that domestic savings do not have a direct causal impact on either trade or GDP, which underscores critical

structural issues such as low savings rates and limited access to financial markets that hinder economic development.

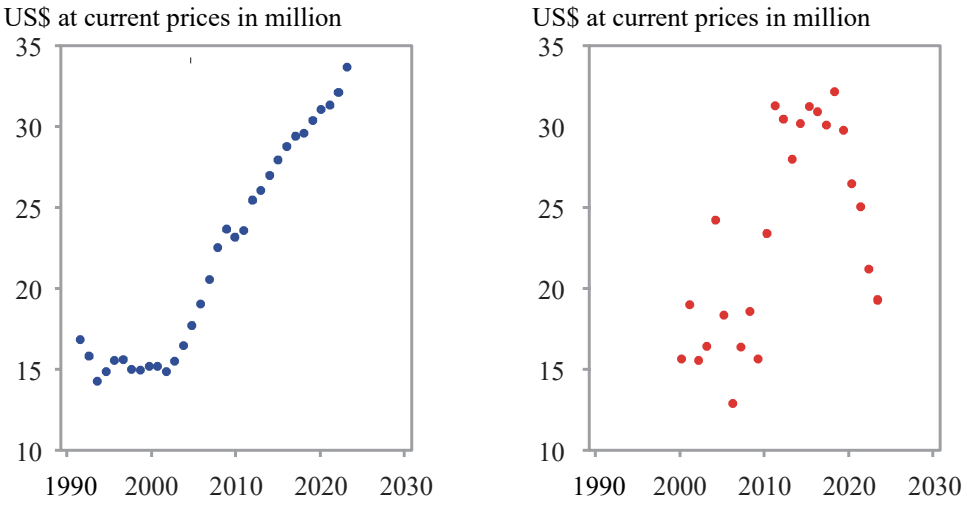
The paper significantly contributes to the broader economic discourse by contextualizing the trade-savings-growth nexus within Ethiopia's unique socio-economic landscape. The implications of our findings are far-reaching, suggesting that targeted policy interventions aimed at enhancing domestic savings and improving trade competitiveness are essential for fostering sustainable economic development.

Furthermore, the insights gained from this study can inform policy makers not only in Ethiopia but also in other developing economies facing similar challenges, highlighting the importance of integrated economic strategies that address the multifaceted nature of growth. Ultimately, this work lays the groundwork for future research into the dynamic relationships between trade, savings, and growth, encouraging a more nuanced understanding of how these elements interact to shape the economic trajectories of nations.

Annex

Figure A1

Cross relation long term trend of gross domestic saving and GDP



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